

PATENT CLAIMS

1. A housing for an LED-chip, comprising a concave-mirror-like or aperture-like, optical element, wherein a continuous, thermally conductive path exists from a fastening surface for the LED-chip to surfaces of the optical element which are open to the outside, in the context that each of the elements constituting this thermally conductive path is either completely metallic or is plastic filled with metal, and the mentioned elements as a sum form a continuous cooling body for the LED-chip.
2. A housing according to claim 1, characterised by a carrier element comprising the fastening surface, for fastening and electrically contacting the LED-chip.
3. A housing according to claim 2, characterised in that the carrier element is at least partly metallic and that a thermally conductive path formed by metal or plastic filled with metal exists between a fastening location for the LED-chip on a front side, and at least 50% of an open rear side of the carrier element.
4. A housing according to claim 3, characterised in that the carrier element is plate-like in sections.
5. A housing according to one of the claims 2 to 4, characterised in that the carrier element is completely metallic, preferably mainly of copper which, possibly completely or locally coated with additional metals.
6. A housing according to one of the claims 2 to 5, characterised in that the carrier element is coated in the vicinity of the LED-chip such that it forms a mirror surface.
7. A housing according to claim 6, characterised in that the carrier element is formed and coated in a vicinity of the LED-chip such that it forms a concave-mirror-like zone.
8. A housing according to one of the claims 2 to 7, characterised in that the carrier element is formed in the vicinity of the LED-chip, such that the LED-chip is lifted from a base surface of the carrier element.
9. A housing according to claim 8, characterised in that the optical element reaches to the base surface of the carrier element and thus to below the LED-chip.
10. A housing according to one of the claims 2 to 9, characterised in that the connection between optical element and the carrier element is at least 50% metallic.

11. A housing according to one of the claims 2 to 10, characterised in that the metallic carrier element is leadframe-like and by way of backfilling suitable openings, is connected to the optical element such that a coherent unit is present after cutting up the leadframe.
12. A housing according to claim 11, characterised in that the backfill is an optically transparent material or a transparent material intermingled with particles of a size smaller than the light wavelength, which is filled into the concave-mirror-like or aperture-like optical element, such that not only does the desired connection of the leadframe sections arise, but additionally, an optically active surface within the concave-mirror-like or aperture-like optical elements, and a protection of the LED-chip and its electrical connections.
13. A housing according to claim 12, characterised in that the backfill of the concave-mirror-like or aperture-like optical element with optically transparent material is made such that on the one hand the desired optical effect and the protective function of the transparent filling material is ensured, but on the other hand that the filling material has such a small thickness, that the concave-mirror-like or aperture-like optical element is not completely filled, by which means firstly the thermally conductive path through the transparent material is as short as possible, and secondly possibly the open surface of the concave-mirror-like or aperture-like optical element is maximised.
14. A housing according to one of the claims 11 to 13, characterised in that the optically transparent material used for the backfill is a material which is stable up to permanent temperatures of at least 150°C, is insensitive to UV-rays and preferably permanently elastic, such as for example silicone or amorphous Teflon AF.
15. A housing according to one of the claims 1 to 13, characterised in that the optically transparent material used for the backfill is a material which is stable up to permanent temperatures of at least 150°C, is insensitive to UV-rays and preferably permanently elastic, such as for example silicone or amorphous Teflon AF, which is filled with small particles (diameter 1 µm to 100 µm) of an inorganic, optically transparent material which has a high thermal conductivity and preferably a refractive index > 1.8, as is for example the case with diamond or titanium oxide.
16. A housing according to one of the claims 11 to 13, characterised in that the optically transparent material used for backfill is a material which is stable up to permanent temperatures of at least 150°C, is insensitive to UV-rays and preferably permanently elastic, such as for example silicone or amorphous Teflon AF, which is filled with nano-structured - in diameter, smaller than the wavelength of visible light - particles of an inorganic, optically transparent

material which has a high thermal conductivity and preferably a refractive index > 1.8, as is for example the case with diamond or titanium oxide.

17. A housing according to one of the preceding claims, characterised in that the optical element is completely metallic.

18. A housing according to one of the preceding claims, characterised in that the outer surfaces of the optical element comprise elements increasing the surface area, for example ribs, for improving the heat transfer to the surrounding medium.

19. A housing according to one of the preceding claims, characterised in that the optical element is designed as an element which with regard to a main radiation direction laterally completely surrounds the LED-chip and projects beyond it in height.

20. A housing according to one of the preceding claims, characterised in that the concave-mirror-like or aperture-like optical element and/or the optically effective surface of an optically transparent filling are designed such that with a light-emitting surface of the LED-chip of up to roughly 0.3×0.3 mm, with a base surface of the finished housing of at the most 1.5×1.5 mm and a height of at the most 1.5 mm, a light exit angle of at the most $\pm 30^\circ$ arises, or that with a light-emitting surface of the LED-chip of up to roughly 0.3×0.3 mm, with a base surface of the finished housing of at the most 2×2 mm and a height of the finished housing of at the most 2 mm, a light exit angle of at the most $\pm 20^\circ$ arises, or that with a light-emitting surface of the LED-chip of up to roughly 0.3×0.3 mm as well as with a base surface of the finished housing of at the most 4×4 mm and a height of at the most 4 mm, a light exit angle of at the most $\pm 10^\circ$ arises, wherein in each case the light exit angle is defined such that outside this angle, the light intensity related to the brightest angular region is smaller than 50%.

21. A housing according to one of the preceding claims, characterised in that the concave-mirror-like optical element and/or the optically effective surface of an optically transparent filling are designed such that with a light-emitting surface of the LED-chip of up to roughly 1×1 mm, with a base surface of the finished housing of at the most 4×4 mm and a height of at the most 3 mm, a light exit angle of at the most $\pm 30^\circ$ arises, or that with a light-emitting surface of the LED-chip of up to roughly 1×1 mm, with a base surface of the finished housing of at the most 7×7 mm and a height of at the most 6 mm, a light exit angle of at the most $\pm 20^\circ$ arises, or that with a light-emitting surface of the LED-chip of up to roughly 1×1 mm as well as with a base surface of the finished housing of at the most 10×10 mm and a height of at the most 12 mm, a light exit angle of at the most $\pm 10^\circ$ arises, wherein the light exit angle is defined such that outside this angle, the light intensity related to the brightest angular region is smaller than 50%.

22. A housing according to one of the preceding claims, characterised in that a concave mirror of the optical element is formed by a mirroring surface surrounding the LED-chip, wherein the mirroring surface is preferably rotationally symmetrical, and wherein a symmetry axis of the concave mirror is preferably perpendicular to the fastening surface.
23. A housed LED, comprising an LED-chip provided with electrical contacts, and a housing according to one of the claims 1 to 22.
24. A housed LED according to claim 23, wherein the housing comprises a carrier element, characterised in that the connection between the LED-chip and the carrier element is completely metallic, thus for example is soldered.
25. A housed LED comprising a LED-chip and an optical element for collimating or focussing light emitted from the LED-chip, characterised in that the optical element comprises a concave mirror which laterally surrounds the LED with respect to a main radiation direction.
26. A housed LED according to claim 25, characterised in that the optical element at least partly is metallic, and projects beyond the LED-chip in height.
27. A housed LED according to claim 25 or 26, characterised in that its housing has the characterising feature of one of the claims 2 to 22.
28. A method for the manufacture of a plurality of housed LED-chips, which in each case comprise a carrier element for the fastening and the electrical contacting of an LED-chip, wherein a large-surfaced or oblong carrier is prestructured, wherein LED-chips are fastened on the carrier and electrically contacted, and wherein the carrier subsequently is provided with a multitude of aperture-like or concave-mirror-like optical elements and divided up into individual carrier elements, wherein the division may be effected before or after the attachment of the concave-mirror-like optical elements.
29. A method according to claim 28, characterised in that subsequent to the attachment of the optical elements, openings in these are filled with transparent material or with materials intermingled with particles of the size of less than a wavelength.
30. A light source, comprising a carrier element and an array of electrically contacted LED-chips present on fastening surfaces of the carrier element, and per LED-chip or unit of several LED-chips, a concave-mirror-like or aperture-like optical element, wherein a continuous thermally conductive path exists from a fastening surface of the LED-chip or the LED-chips to

surfaces of the optical element which are open to the outside, in the context that each of the elements constituting this thermally conductive path is either completely metallic or is plastic filled with metal, and the mentioned elements as a sum, form a continuous cooling body for the LED-chip.

31. A light source according to claim 30, characterised in that the carrier element is at least partly metallic and that a thermally conductive path formed by metal or plastic filled with metal exists between a fastening location for the LED-chip or the LED-chips on a front side, and at least 50% of an open rear side of the carrier element.

32. A light source according to claim 30 or 31, characterised in that the carrier element is plate-like in sections, in the context of a two-dimensional flex-print or a strip-like leadframe.

33. A light source according to one of the claims 30-32, characterised in that the carrier element is essentially metallic in the context that it comprises at least one metal layer - preferably consisting mainly of copper, potentially coated completely or locally with additional metals - which at the location of the LED-chip or LED-chips penetrates possibly present non-metallic layers, such that the surface of the penetration corresponds at least to the chip surface, and that metal comes to the surface on both sides of the carrier element.

34. A light source according to one of the claims 30-33, characterised in that the carrier element in a vicinity of the LED-chip is coated such that it forms a mirror surface.

35. A light source according to claim 30-34, characterised in that the connection between the optical element and the carrier element is at least 50% metallic in that it is soldered for example.

36. A light source according to one of the claims 30 - 35, characterised in that a filling of the concave-mirror-like or aperture-like element with optically at least partly transparent material is present, which either completely fills out the concave-mirror-like or aperture-like optical element, or preferably has such a small thickness, that it does not completely fill the concave-mirror-like or aperture-like optical element.

37. A light source according to claim 36, characterised in that the filling is stable at permanent temperatures of at least 150°C, permanently elastic and preferably insensitive to UV-rays, preferably is silicone or amorphous Teflon AF.

38. A light source according to claim 36 or 37, characterised in that the optical transparent material is filled with small particles with a diameter 1 µm to 100 µm of an inorganic, optically

transparent material which for example has a high thermal conductivity and/or preferably a refractive index > 1.8, as is the case for example with diamond or titanium oxide.

39. A light source according to one of the claims 36 to 38, characterised in that the optically transparent material is filled with nano-structured, which is to say smaller in diameter than the wavelength of visible light, particles of an inorganic, optically transparent material, which preferably has a high thermal conductivity and a refractive index > 1.8, as is the case for example with diamond or titanium oxide.

40. A light source according to one of the claims 30- 39, characterised in that the optical element is completely metallic.

41. A light source according to one of the claims 30 - 40, characterised in that outer surfaces of the optical element comprise elements increasing the surface area, for example ribs, for improving the heat transfer to the surrounding medium.

42. A light source according to one of the claims 30-41, characterised in that the optical element is designed as an element which with regard to a main radiation direction laterally completely surrounds the LED-chip or the unit of LED-chips, and projects beyond it in height.

43. A light source according to one of the claims 30-34, characterised in that a concave-mirror of the optical element is formed by a mirroring surface surrounding the LED-chip or the unit of LED-chips, wherein the mirroring surface is preferably rotationally symmetrical and wherein an axis of symmetry of the concave mirror is preferably perpendicular to the fastening surface.

44. A light source according to one of the claims 30 - 43, characterised by first and second contact zones for the electrical contacting of the LED-chips, wherein at least from the first contact zones, a continuous metallic, thermally conductive path to the rear side of the carrier element exists.

45. A light source according to claim 44, characterised in that an electrical connection exists also from the second contact zones to the rear side of the carrier element.

46. A light source, in particular according to one of the claims 30 - 45, comprising a carrier element, and deposited thereon, an array of LED-chips, wherein the carrier element may be subdivided into carrier element regions, and exactly one carrier element region is allocated to each LED-chip or each unit of several LED-chips arranged next to one another and for example emitting in different spectral ranges, and wherein a carrier element region comprises a first and a

second contact zone for electrically contacting the LED-chip, characterised in that the first and the second contact zone are electrically connected to one another.

47. A light source according to claim 46, characterised in that the first and the second contact zone may be electrically insulated from one another by way of separating the carrier element region from the rest of the light panel.

48. A housing for a light source according to one of the claims 30 - 47 with a carrier element with fastening surfaces for an array of LED-chips or units of in each case several LED-chips, and per LED-chip or unit, a concave-mirror-like or aperture-like element, wherein a continuous, thermally conductive path exists from a fastening surface of the LED-chip or LED-chips to surfaces of the optical element which are open to the outside, in the context that each of the elements constituting this thermally conductive path is either completely metallic or is plastic filled with metal, and the mentioned elements in sum form a continuous cooling body for the LED-chip.